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(71) Applicant
Etablissements Maurice Maillard,

(Incorporated in France),

76117 Incheville, (Seine Maritime), France

(72) Inventor
Edouard Monka

(74) Agent and/or Address for Service
Urquhart-Dykes & Lord, 91 Wimpole Street, London W1M 8AH

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B3A
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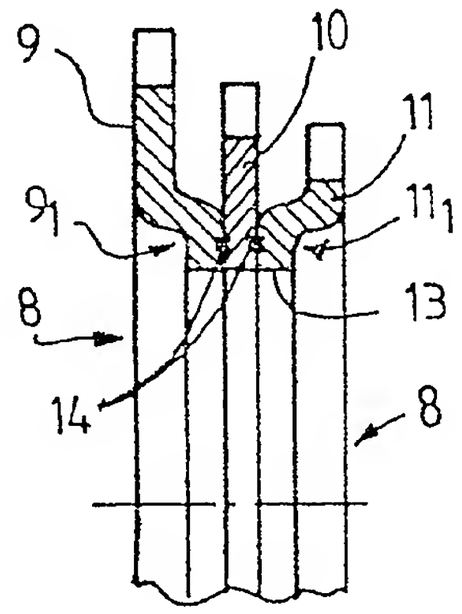
(54) Making bicycle Derailleur gear wheel assembly

(57) Derailleur free-wheel gearwheels (9, 10, 11) are each made by a pressing and blanking operation on a metal sheet. Outer gearwheels have pressed-in rims 9, 11, the central wheel being flat. The gearwheels (9, 10, 11) are welded together, the concave rims (9_1, 11_1) of the pressings are machined to provide ball races and the edges of the central apertures of the welded gearwheels are cut to provide ratchet teeth for cooperation with a central hub ratchet. More than three wheels can be welded together.

FIG. 2



The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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FIG.1

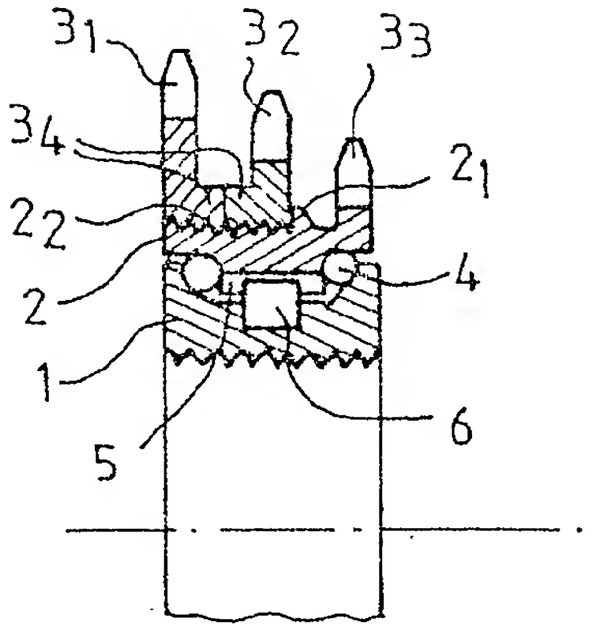


FIG.5a FIG.5b FIG.5c

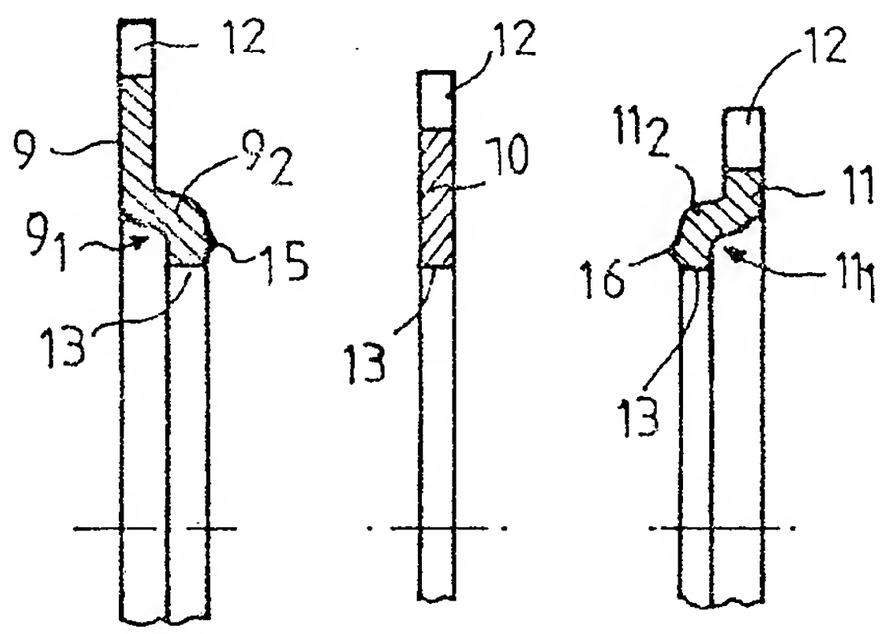


FIG.2

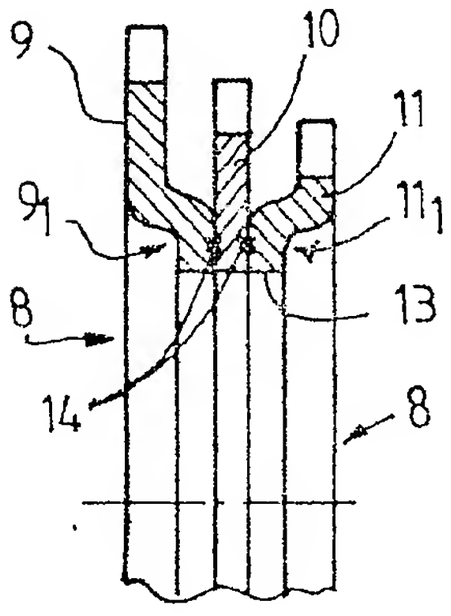


FIG.3

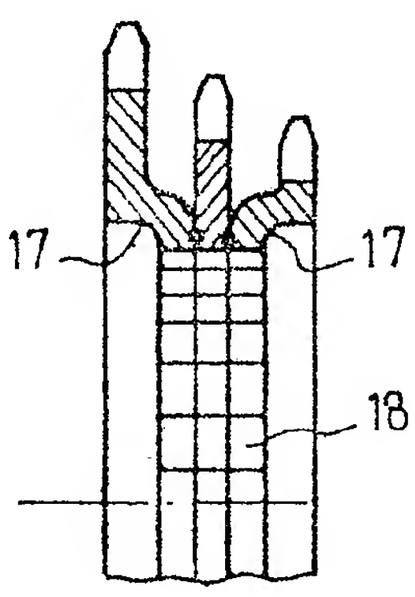


FIG.4

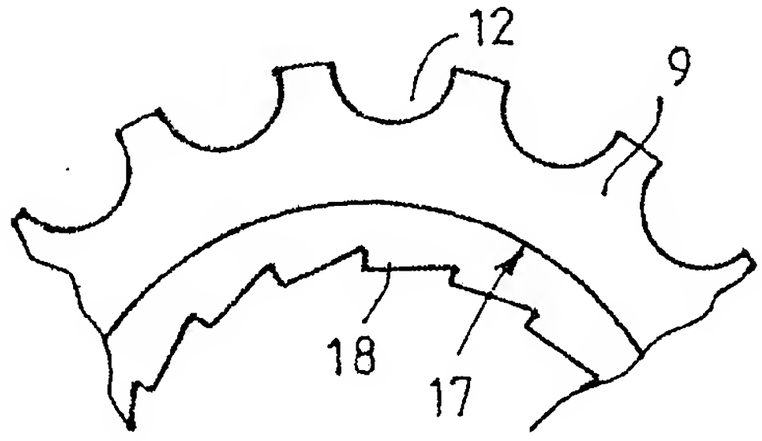


FIG.7

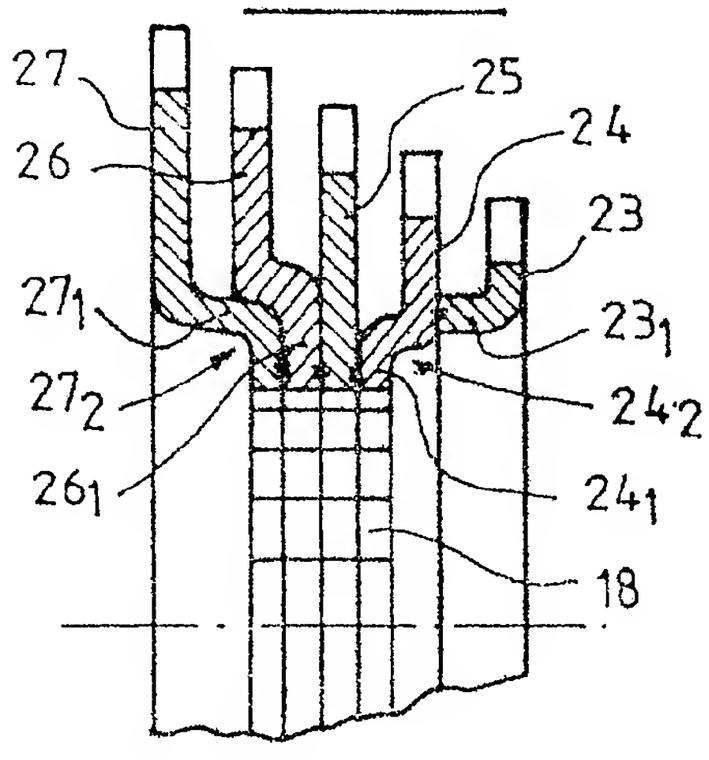
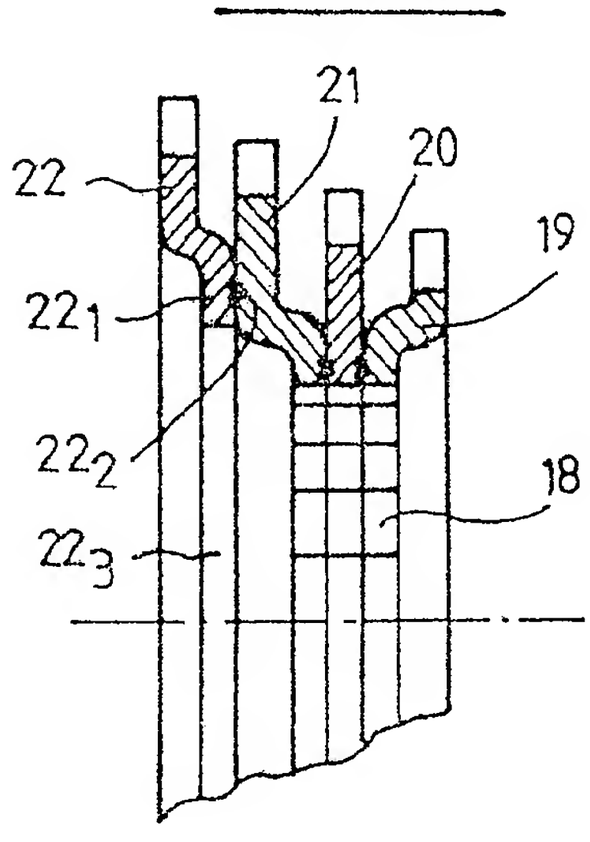


FIG.6



SPECIFICATION

Method of manufacturing a multi-gear bicycle freewheel for a derailleur gear, and the resulting freewheels

This invention relates to a method of manufacturing a multi-gear freewheel and the freewheels produced by this method.

Bicycle freewheels comprise a hub 1 having a tapped central aperture adapted to fit over the screw-threading of the hub of the wheel of a bicycle. A crown 2 bearing gearwheels 3 adapted to cooperate with the bicycle chain is mounted rotatably on the hub.

The crown 2 is mounted rotatably on the hub 1 by means of the balls 4 of a bearing disposed in corresponding raceways formed opposite one another in the crown and in the hub. The crown 2 also has ratchet teeth 5 between its two raceways, spring-biased pawls 6 co-operating with the ratchet teeth.

In the type of manufacture commonly used today, all or some of the gearwheels of the freewheel are made separately and are then connected, generally by screwing or by means of a nut, on the crown which is machined separately.

Thus as shown in the accompanying Figure 1, the smallest-diameter gearwheel 3_3 forms an integral part of the crown 2 which also has an abutment rim 2_1 and a screwthreaded part 2_2. The other two gearwheels 3_1 and 3_2 are made separately by pressing and blanking operations and are fixed by screwing on the screwthreading 2 of the crown. During the manufacture of these gearwheels 3_1, 3_2, rims 3_4 are also made, the height of which is adapted to determine the spacing between the adjacent gearwheels 3_1, 3_2.

Such manufacture is complex however, in view of the number of parts required to be manufactured separately, the complex shape of those parts and also the fact that these parts in large numbers have to be heat-treated separately, e.g. in order to case-harden them.

The object of this invention is to obviate these disadvantages and to this end the invention relates to a method of manufacturing a multi-gear bicycle freewheel for a derailleur gear, the gearwheels of the freewheel being fixed on the outer surface of a hollow freewheel body which is in turn mounted rotatably on an assembly hub through the agency of ball bearings and a pawl and ratchet assembly, for which purpose the outer surface of the hollow body has two circular raceways for the balls, said raceways framing a circular ratchet teeth zone, the method being characterised in that the freewheel gearwheels are made by a pressing and blanking operation on a metal sheet, the operation being such as to:

- form the peripheral teeth of the gearwheels, the outer diameter of said gearwheels being different for one and the same freewheel,
- form a central aperture on these gearwheels, said central aperture being of the same diameter for the gearwheels in question,
- form a circular pressed rim offset from the plane of the gearwheel, on the edge of the central aperture of said gearwheels, except for one of the gearwheels which has an intermediate outside diameter, these pressings being made so that the gearwheels are equidistant from one another when they are juxtaposed in a graduated arrangement of their outside diameters, the gearwheels are welded together by their pressed circular rim and by the edge of the aperture of the one which has not been pressed, the concave parts of the two outer pressings of the resulting assembly are machined to form the raceways for the freewheel ball bearing and the edges of the apertures of the welded gearwheels are cut to form the ratchet teeth there.

According to another feature of the invention, in a pressing and blanking operation an additional freewheel gearwheel is produced which has its teeth and its circular pressed rim, the central aperture however being of a larger diameter than that of the apertures having the ratchet teeth, said additional gearwheel being secured laterally by welding to one of the outer gearwheels of the assembly.

The invention is illustrated by way of example without limiting force in the accompanying drawings wherein:

Figure1 is an axial half-section of a freewheel of known make.

Figure 2 is an axial half-section of a crown and gearwheel assembly according to the invention in the course of manufacture.

Figure 3 shows the assembly of Figure 2 after final machining.

Figure 4 is a partial view of the left-hand part of Figure 3.

Figures 5a, 5b, 5c illustrate the three gearwheels used as a basis for the manufacture of the assembly shown in Figures 2 to 4.

Figures 6 and *7* are half-sections of two other embodiments of freewheels according to the invention.

The invention relates to the manufacture of a multi-gear bicycle freewheel which is simple and relatively uncomplicated to produce while being very strong.

The method according to the invention consists generally in making a crown and gearwheel assembly from gearwheels made in a specific way and welded to one another.

Thus referring to Figures 2 to 4, the crown and gearwheel assembly 8 comprises three gearwheels 9, 10 and 11 of staged diameters produced by blanking from sheets of metal so as to form, first, the peripheral teeth 12 and, second, identical-diameter central apertures 13. The central gearwheel 10 is flat while the end gearwheels 9 and 11 are pressed circularly at 9_1 and 11_1, on the edge of their central aperture 13, to form offset rims 9_2 and 11_2, the offsetting height corresponding to the required spacing of the gearwheels 9 and 11 from the central gearwheel 10.

These gearwheels, which are thus made in one pressing and blanking operation, are juxtaposed and assembled by a welding operation 14 which

involves the facing contiguous surfaces of the central gearwheel 10 and the rim 11_2 and 12_2.

The weld to connect the gearwheels may be a discontinuous spot weld or alternatively a continuous weld produced, for example, by resistance welding. To obtain good quality welding, the end gearwheels 9 and 11 and/or the central gearwheel 10 will preferably have slight bosses 15 defining a circular discontinuous or continuous line so that after centring and pressing of the three gearwheels the resistance welding operation will involve basically these circular zones 15 and 16.

When the gearwheel assembly has been made in this way, it is subjected to a machining operation intended, first, to form raceways in the concave parts of the pressings 9_1, 11_1, and then to cut the ratchet teeth 18 on the edge of the coaxial equal-diameter apertures of the three gearwheels.

Preferably, the circular pressings 9_1, 11_1 are made so as to have concave surfaces which in cross-section are circular and of a diameter substantially euqal to that of the bearing balls so that the final machining after welding can be carried out quickly without the removal of an excessive amount of material.

The final operation will then comprise subjecting the resulting assembly to a case-hardening operation to give the metal the required hardness.

This production process can therefore greatly reduce the cost of producing freewheels since the gearwheel assembly whether the flat central gearwheel 10 or the two outer curved gearwheels can readily be made on high-speed blanking presses, assembly being readily carried out quickly by resistance welding or the like.

The exemplified embodiment shown in Figures 2 to 4 illustrates a three-gearwheel freewheel gearwheel and crown assembly. The method according to the invention will, however, enable four or five gearwheel assemblies to be made easily.

For examples, Figure 6 shows an assembly of three gearwheels 19, 20 and 21 made and assembled in the same way as the gearwheels 9, 10 and 11 in the embodiment shown in Figures 2, 3 and 4, while an additional gearwheel 22 is fixed to the gearwheel 21. Gearwheel 22 is also produced by pressing and blanking to form an offsset rim 22_1 which is then welded at 22_2 to the outer side surface of the gearwheel 21.

Of course, in this case the central aperture 22_3 of the gearwheel 22 is of a larger diameter than that of the gearwheels 19, 20 and 21 while the height of the offset rim 22_1 is such that after assembly the gearwheels 19, 20, 21 and 22 are equidistant.

The embodiment shown in Figure 7 is a crown and gearwheel assembly of five gearwheels 23, 24, 25, 26 and 27.

Gearwheel 25 is flat, gearwheel 24 has a pressed rim 24_1 on the edge of its central aperture and is welded to the facing surface of the flat gearwheel 25. The smallest-diameter gearwheel 23 has a circular flange 23_1 and is welded by the end of said flange to the facing surface of the gearwheel 24.

The gearwheels 26 and 27 also have circularly pressed rims 26_1 and 27_1 on the edge of their central aperture, these pressings being so made, however, as to fit one inside the other. These two rims 26_1, 27_1 are welded together and to the flat gearwheel 25 after which they undergo machining to form the raceways 24_2, 27_2 for the bearing balls and the ratchet teeth.

It will be seen in the examples illustrated that the ratchet teeth 18 are formed over the entire width of the equal-diameter central aperture of the gearwheels, thus giving a direct connection between the freewheel retaining ratchets 6 and the gearwheel rathcet engaging the chain. The forces are therefore transmitted directly from the chain to the pawls and to the freewheel sprocket through the gearwheel in question without the welded connecting zones being involved in this power transmission.

CLAIMS

1. A method of manufacturing a multi-gear bicycle freewheel for a derailleur gear, the gearwheels of the freewheel being fixed on the outer surface of a hollow freewheel body which is in turn mounted rotatably on an assembly hub through the agency of ball bearings and a pawl and ratchet assembly, for which purpose the inner surface of the hollow body has two circular raceways for the balls, said raceways framing a circular ratchet teeth zone, the method being characterised in that the freewheel gearwheels (9, 10, 11) are made by pressing and blanking operations on a metal sheet, the operations being such as to;
- form the peripheral teeth (12) of the gearwheels, the outer diameter of said gearwheels being different for one and the same freewheel;
- form a central aperture (13) on these gearwheels, said central aperture being of the same diameter for the gearwheels in question;
- form a circular pressed rim (9_2, 11_2), offset from the plane of the gearwheel, ont he edge of the central aperture of said gearwheels, except for one of the gearwheels (10) which has an intermediate outside diameter, these pressings being made so that the gearwheels are equidistant from one another when they are juxtaposed in a graduated arrangement of their outside diameters, the gearwheels (8, 10, 11) are welded together by their pressed circular rim (9_2, 11_2) and by the edge of the aperture (13) of the one which has not been pressed, the concave parts (9_1, 11_1) of the two outer pressings of the resulting assembly are machined to form the raceways for the freewheel ball bearing and the edges of the apertures (13) of the welded gearwheels are cut to form the ratchet teeth there.

2. A method according to claim 1, charachterised in that in a pressing and blanking operation an additional freewheel gearwheel (22) is produced which has its teeth and its circular pressed rim (22_1), the central aperture (22_3) however being of a larger diameter than that of the apertures having the ratchet teeth (18), said additional gearwheel being secured laterally by welding to one (21) of the outer gearwheels of the assembly.

3. A method according to claim 1, characterised

in that an additional gearwheel (23) is produced which hasits teeth and a central aperture with a flange (23_1), said additional gearwheel being secured by welding by the end of its flange to one (24) of the outer gearwheels of the assembly.

4. A method according to claim 1, characterised int hat the assembly comprises at least two gearwheels (26, 27) the pressings (26_1, 27_1) of which are made so as to fit one inside the other.

5. A method according to any one of the preceding claims, characterised int hat bosses (15) defining a circular line adapted to facilitate the connection of the gearwheels by welding are provided on the pressed rims of the gearwheels and/or on the edge of the aperture of the gearwheel which is not pressed.

6. A method of manufacturing a multi-gear bicycle freewheel for a derialleur gear, said method being substantially as described herein with reference to Figures 2 to 5, Figure 6 or Figure 7 of the accompanying drawings.

7. A method according to claim 1 and substantially as herein described.

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